PECULIARITIES IN THE ANGIOARCHITECTONICS OF THE LYMPH NODES IN MAN

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Architectonics of the lymph nodes is essential for their structure. Its study is of utmost importance for understanding some aspects of the physiology and pathology of lymph nodes.

A number of authors do not rule out the possibility of form elements exchange between blood and lymphoid tissue within the lymph node which is dependent upon the structure of the microcirculatory system and its relation to the structural elements of the lymph node (Bloom and Fawcett, 1968; Bucher, 1970; Stöhr, Mollendorf, Goertler, 1969, etc.). Over the past few years this particular problem has been dealt with by Odintzova (1971), Dolgova (1967, 1970), Egorova (1965), Demidova (1964), Borisov (1961), Kubik (1952) and others. Nevertheless, not all characteristic features in the structure of the vascular system have been investigated to a sufficient degree, while some of the data available are conflicting, facts which led us to undertake studies with the purpose to clarify some of the as yet obscure and disputed questions.

Material and Method

Lymph node preparations with blood vessels subjected in advance to India ink—gelatin contrast staining (according to Vankov, 1968) are used. Observations are made on serial sections with thickness 60 and 90 microns, cleared without beforehand staining, as well as on sections stained after the method of Van Gieson, especially standardized for the purpose.

Results

Most arteries enter a lymph node through the hilus and are radially directed to its periphery. Along their course they give off lateral branches for the medullar cords, and terminal branches for the cortical substance. Tridimensional capillary networks are formed in the medullar cords, with the larger caliber vessels being situated in the center (Fig. 1).

The build up of the vascular bed in the cortical layer displays essential difference due largely to its histological structure peculiarities. Uniformly distributed vascular networks are formed in the primary follicles. The build up of the secondary follicles' vascular bed is much more complex. Therein a central plexus consisting of dilated vessels, situated in the rudimentary center, and a vascular network in the periphery of the follicle are differentiated. The central capillary network communicates with the

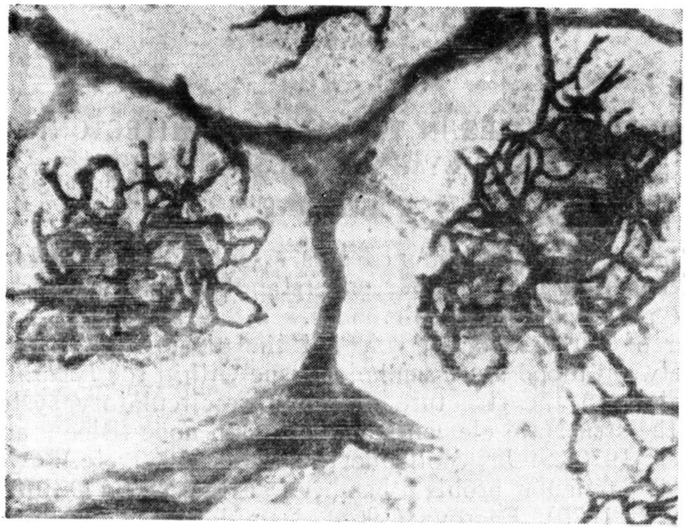

Fig. 1. Transverse section through the medullary cords. Peripherally situated capillary networks, in the center — afferent and efferent vessels. Inguinal lymph node from a 15-year-old individual. Van Gieson. Microphotograph: ob. 10, oc. 20.

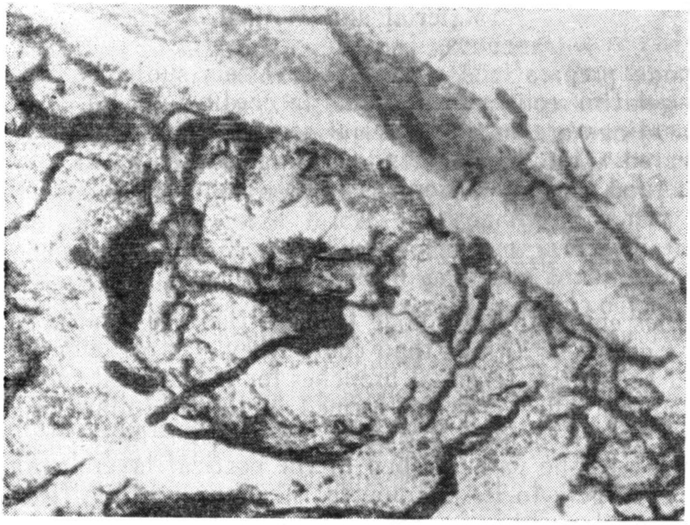

Fig. 2. Secondary lymph follicle with a central and peripheral vascular network. Mesenchymal lymph node from a 3-year-old individual. Van Gieson. Microphotograph: ob. 10, oc 20.

peripheral vascular network of the follicle through slightly branched vessels of the order of capillaries (Fig. 2). In a number of preparations larger vessels are also seen, supplying with blood or draining the central vascular plexus, as well as an arterial vessel coming from the periphery and forming the peripheral follicular network, and a venous vessel draining the latter (Fig. 3).

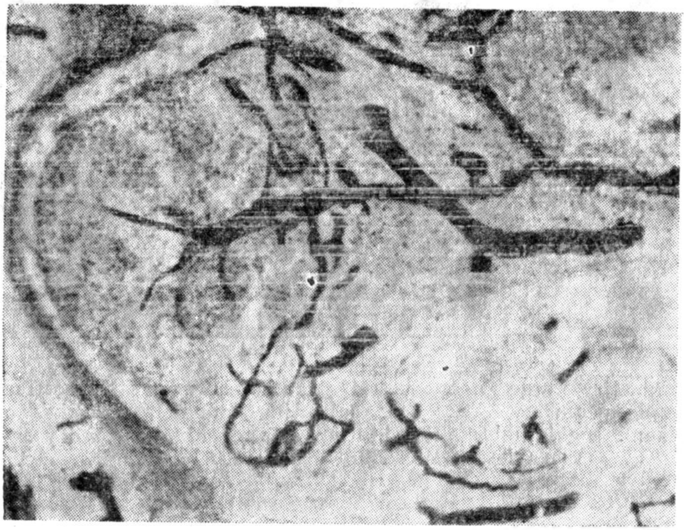

Fig. 3. Secondary lymph follicle. Artery and vein for the central vascular plexus. Mesenteric lymph node from a 13-year-old individual. Van Gieson. Microphotograph: ob. 10, oc. 20.

At the points of undifferentiated follicles, the arteries entering the cortical substance undergo arborization into vessels directed radially to the marginal sinus. In the vicinity of the latter they form capillary networks which, in turn, give rise to the venous vessels. The efferent vessels run a radial course towards the hilus. By caliber and quantity they outnumber considerably the arterial trunks. The veins of the cortical part and medullary substance empty into collector veins, situated in between the cortical portion and the medullary substance (Fig. 4). Usually, the venous vessels do not accompany their respective arterial trunks.

The arterial or venous vessels of the cortical part are not isolated from the vessels of the medullary substance. We did not come across the special vessels, described in the literature, reaching the cortical substance and, more particularly, its follicles, and failing to give off branches in the medullar part.

Our study demonstrates that the parenchymatous vascular network of a node communicates in one or another way with the blood vessels of the surrounding tissue. Regardless of the fatcthat the capsular vascular network

Fig. 4. A large venous vessel situated between the cortical and medullary substance, collecting blood from either of them. Inguinal lymph node from an individual aged 3 years. Van Gieson. Microphotograph: ob. 10, oc. 20.

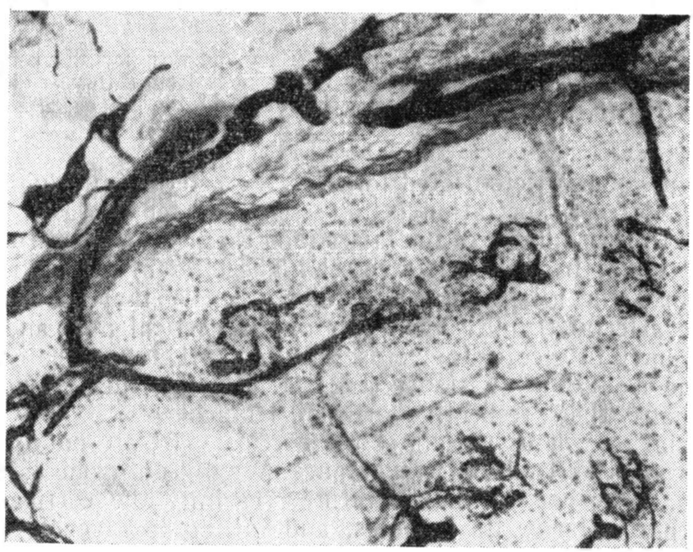

Fig. 5. Trabecular vessel entering through the capsule (on the left), and a vessel directly crossing the marginal sinus (on the right). Inguinal lymph node from an individual aged 15. Van Gieson. Microphotograph: ob. 10, oc. 20.

is usually independent, at certain points it may contact the cortical vascular network. In numerous preparations blood vessels are noted entering the lymph node at the convex part, and penetrating its substance either via the trabeculae, or after crossing directly the capsule and the marginal sinus (Fig. 5).

Fig. 6. Perforating vessel giving off branches for the cortical and medullary substance blood supply. Mesenteric lymph node from a 13-year-old individual. Van Gieson. Microphotograph: ob. 4, oc. 10.

In some of the sections perforating vessels are detected with branches participating in the blood supply of the node parenchyma. In an oblique section through a perforating blood vessel, enveloped in a connective tissue canal, it can be seen that the branches of the vessel piercing the canal ramify both in the medullary and in the cortical part of the node (Fig. 6).

Discussion

From the data presented it is evident that the lymph nodes are supplied with blood by vessels entering the lymph node, in their greater part, through the hilus. Along with that, vessels entering the node at the convex surface by way of the trabeculae or by passing directly through the capsule and marginal sinus, as well as branches of the vessels perforating them also participate in the blood supply of the node.

According to Dolgova (1967), the arteries arising from the convex side of the inguinal lymph nodes form an arcade around them, wherefrom several trunks enter the capsule. However, the author makes no reference to whether or not these vessels or their branches take part in the vascularization of the node parenchyma. Demidova (1964) observed only isolated arteries entering the node through the capsule along the forming trabeculae. Borisov (1961) points out that after entering a lymph node at many point of its surface, the arteries anastomose between each other and thereby form a plexus within the node. Our results do not corroborate the data submitted by Borisov. The plexuses described are formed by blood vessels entering through the hilus. No evidence of perforating vessels' participation in the vascularization of the lymph node is found in the literature.

Our data demonstrate that tridimensional vascular networks are formed in the medullar cords, occupying mainly their peripheral parts, with the vessels having larger calibers being usually situated in the central parts of the cords. In general outline, the latter finding complies with some of the literature reports (Blood and Fawcett, 1968)

The structure of the vascular bed in the cortical substance shows essential differences, conditioned to a certain extent by its histological build-up peculiarities. A similar opinion is supported by Stöhr, Mollendorf and Goerttler also. However, the authors just cited do not describe the character of these networks. In the primary follicles, uniformly distributed vascular networks are formed, in the secondary — a central plexus made up of dilated vessels, situated in the rudimentary center, as well as a peripheral vascular network, all communicating between each other. The blood in the central plexus is supplied and returned via independent vessels. No reference to the differences outlined was found in the literature. At the points of undifferentiated follicles, the arteries entering the cortical substance are arborized into vessels directed to the marginal sinus. Near by the latter they form capillary networks which give rise to venous vessels.

The vascular networks of the cortical substance, the medullar cords and the capsule are by no means isolated from each other. They communicate both with one another, and with the surrounding vessels. This points to the great adaptive and compensatory possibilities of the intraorganic vessels in the lymph nodes.

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НЕКОТОРЫЕ ОСОБЕННОСТИ АНГИОАРХИТЕКТОНИКИ ЛИМФАТИЧЕСКИХ УЗЛОВ У ЧЕЛОВЕКА

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РЕЗЮМЕ

Исследованы серийные срезы паховых и брыжеечных лимфатических узлов с примененной методикой инъекции кровеносных сосудов контрастной массой из тушь-желатина. Исследована ангиоархитектоника лимфатических узлов. Более подробно рассматриваются источники кровоснабжения, характер сосудистых сетей в корковых фоликулах, мозговой субстанции и капсуле, связь между ними, участие перфорирующих сосудов в кровоснабжении узла.